

counterclockwise torque generated on the stator 11 by a current command value, the magnetic screw 1 in the male side linearly moves in the axial direction. Therefore, an output having higher positioning accuracy can be generated.

PATENT ABSTRACTS OF JAPAN

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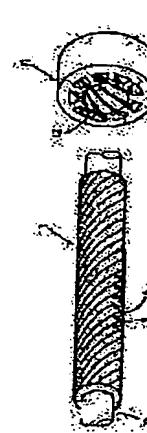
(21)Application number : 09-058039 (71)Applicant : CKD CORP
(22)Date of filing : 12.03.1997 (72)Inventor : KUSUMI SABURO

(54) MOTOR AND OUTPUT APPARATUS PROVIDING THE SAME MOTOR

(57)Abstract:

PROBLEM TO BE SOLVED: To obtain a motor which can generate a higher level output of the positioning accuracy by fixing a rod, supporting the stator to freely slide in the axial direction of the rod and applying a current to the coil of each phase wound to the stator to generate a propelling force with a rotary magnetic field generated.

SOLUTION: A rotary magnetic field is generated by supplying a command current to the coil of each phase of a stator 11 from a control system. With generation of a rotary magnetic field, an N-pole magnetized band 3 and S-pole magnetized band 4 of a magnetic screw 1 of the male side are attracted and a rotating torque works on the rod 2. However, since the rod 2 is fixed and restricted in its rotation, its rotating torque is transferred as a propelling force in the axial direction for the N-pole magnetized band 3 and S-pole magnetized band 4 of the magnetic screw 1 of the male side spirally magnetized. Therefore, with a clockwise and



band-like N pole and the south pole was spirally magnetized to the rod which consists of a ferromagnetic material, Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. By the rotating magnetic field which the guidance projection which protruded perpendicularly to said rod is guided in the rail slot formed in the frame which supports said stator, makes energize the coil of each phase wound around said stator, and produces The output unit characterized by said rod promoting or rotating according to said rail slot.

[Translation done.]

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CLAIMS

[Claim(s)]

[Claim 1] The motor characterized by having a stator with the salient pole which learned in the shape of [of the magnetization band which fitted into the male side MAG screw with which the magnetization band of band-like N pole and the south pole was magnetized spirally, and said male side MAG screw in the state of non-contact to the rod which consists of a ferromagnetic material, and was magnetized by said rod] a screw type, and was formed.

[Claim 2] The male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod which consists of a ferromagnetic material, Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. The output unit characterized by making said rod generate a thrust by the rotating magnetic field which are made to energize the coil of each phase wound around said stator by fixing said stator and supporting said rod free [sliding] to shaft orientations, and are produced.

[Claim 3] The male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod which consists of a ferromagnetic material, Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. The output unit characterized by making the stator concerned generate a thrust by the rotating magnetic field which are made to energize the coil of each phase wound around said stator by fixing said rod and supporting said stator free [sliding] to the shaft orientations of said rod, and are produced.

[Claim 4] The male side MAG screw with which the magnetization band of

carried out in the magnetic screw, a rotation output is transmitted to a shaft 51 by the drive of a motor 56 through a belt 55. On the other hand, between the male side MAG screw 71 and the female side MAG screw 72, a magnetism operation with the magnet 53 wound around the shaft 51 and the magnet 60 attached in the conveyance base 58 arises, and it attracts each other. Therefore, if a shaft 51 rotates, rotation of a magnet 53 serves as a driving force of the magnet 60 of the conveyance base 58 where rotation was restricted, and the conveyance base 58 will move linearly along with the guide rod 61. Moreover, if a motor 56 is rotated conversely, magnetism will act on both magnets to hard flow, and double action of the conveyance base 58 will be carried out.

[0005]

[Problem(s) to be Solved by the Invention] However, since it consisted of such conventional output units so that it may transmit through the belt 55 over which the pulleys 54 and 56 formed in the revolving shaft 51 and the output shaft of a motor 56 were built in order to rotate the male side MAG screw 71, there was a trouble that a lifting and location precision did not come out of backlash, at the time of a halt or an inversion. Moreover, while the tooth space between these drive systems will be needed and equipment itself will be enlarged, it is also the cause which raises the price of equipment by the costs which a drive system takes.

[0006] Then, the positioning accuracy equipped with the motor which can be made to generate the high output of positioning accuracy, and such a motor that this trouble should be canceled is high, and this invention aims at offering a small and cheap output unit.

[0007]

[Means for Solving the Problem] The motor of this invention is a motor which has a stator with the salient pole which learned in the shape of [of the magnetization band which fitted into the male side MAG screw with which the magnetization band of band-like N pole and the south pole was magnetized spirally, and said male side MAG screw in the state of non-contact to the rod which consists of a ferromagnetic material, and was magnetized by said rod] a screw type, and was formed. The male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material. Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. It is characterized by making said rod generate a thrust by the rotating magnetic field produced by energizing the coil of each phase wound around said

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates rectilinear motion and rotation to the output unit which controls an output by the motor at the motor list using a magnetic screw.

[0002]

[Description of the Prior Art] The magnetic screw formed from the former with the combination of the male side MAG screw which magnetized the magnet in the shape of a screw type, and a female side MAG screw is used, and the output unit which changes and outputs rotation to the translatory movement is indicated. Then, what was carried by JP,1-209222,A as a conventional example of an output unit is shown and explained. Drawing 6 is the sectional view having shown the output unit indicated in the official report concerned, and is making the following configurations. A shaft 51 is supported by the bearing 52 of the ball bearing in which both ends were attached by fixed parts, such as a frame, free [rotation], the band-like magnet 53 of the south pole and N pole is spirally magnetized by turns by the shaft 51 front face, and the male side MAG screw 71 is constituted. And a pulley 54 is fixed to the end of the shaft 51 supported by bearing 52, and between the pulleys 57 of a motor 56, a belt 55 hangs and is ****(ed).

[0003] The conveyance base 58 in which the cross section was shown is formed so that the guide rod 61 formed so that it might not rotate at the time of migration, and the male side MAG screw 71 may be wrapped. And inside [cylinder hole 59] this conveyance base 58, the female side MAG screw 72 magnetized so that the band-like magnet 60 of the south pole and N pole might involve in spirally is constituted. Moreover, only spacing a is vacated and arranged so that it may not contact mutually [a magnet 53 and a magnet 60] within the cylinder hole 59 which a shaft 51 penetrates.

[0004] Thus, as for the output unit by which the use **** configuration was

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TECHNICAL FIELD

[Field of the Invention] This invention relates rectilinear motion and rotation to the output unit which controls an output by the motor at the motor list using a magnetic screw.

[Translation done.]

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stator by fixing said stator and supporting said rod free [sliding] to shaft orientations.

[0008] Moreover, the male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material. Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. It is characterized by making the stator concerned generate a thrust by the rotating magnetic field which are made to energize the coil of each phase wound around said stator, and are produced by fixing said rod and supporting said stator free [sliding] to the shaft orientations of said rod.

[0009] Moreover, the male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material,

driving force of the magnet 60 of the conveyance base 58 where rotation was restricted, and the conveyance base 58 will move linearly along with the guide rod 61. Moreover, if a motor 56 is rotated conversely, magnetism will act on both magnets to hard flow, and double action of the conveyance base 58 will be carried out.

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PRIOR ART

[Description of the Prior Art] The magnetic screw formed from the former with the combination of the male side MAG screw which magnetized the magnet in the shape of a screw type, and a female side MAG screw is used, and the output unit which changes and outputs rotation to the translatory movement is indicated. Then, what was carried by JP,1-209222,A as a conventional example of an output unit is shown and explained. Drawing 6 is the sectional view having shown the output unit indicated in the official report concerned, and is making the following configurations. A shaft 51 is supported by the bearing 52 of the ball bearing in which both ends were attached by fixed parts, such as a frame, free [rotation], the band-like magnet 53 of the south pole and N pole is spirally magnetized by turns by the shaft 51 front face, and the male side MAG screw 71 is constituted. And a pulley 54 is fixed to the end of the shaft 51 supported by bearing 52, and between the pulleys 57 of a motor 56, a belt 55 hangs and is ****(ed). [0003] The conveyance base 58 in which the cross section was shown is formed so that the guide rod 61 formed so that it might not rotate at the time of migration, and the male side MAG screw 71 may be wrapped. And inside [cylinder hole 59] this conveyance base 58, the female side MAG screw 72 magnetized so that the band-like magnet 60 of the south pole and N pole might involve in spirally is constituted. Moreover, only spacing a is vacated and arranged so that it may not contact mutually [a magnet 53 and a magnet 60] within the cylinder hole 59 which a shaft 51 penetrates. [0004] Thus, as for the output unit by which the use *** configuration was carried out in the magnetic screw, a rotation output is transmitted to a shaft 51 by the drive of a motor 56 through a belt 55. On the other hand, between the male side MAG screw 71 and the female side MAG screw 72, a magnetism operation with the magnet 53 wound around the shaft 51 and the magnet 60 attached in the conveyance base 58 arises, and it attracts each other. Therefore, if a shaft 51 rotates, rotation of a magnet 53 serves as

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TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] However, since it consisted of such conventional output units so that it may transmit through the belt 55 over which the pulleys 54 and 56 formed in the revolving shaft 51 and the output shaft of a motor 56 were built in order to rotate the male side MAG screw 71, there was a trouble that a lifting and location precision did not come out of backlash, at the time of a halt or an inversion. Moreover, while the tooth space between these drive systems will be needed and equipment itself will be enlarged, it is also the cause which raises the price of equipment by the costs which a drive system takes.

[0006] Then, the positioning accuracy equipped with the motor which can be made to generate the high output of positioning accuracy, and such a motor that this trouble should be canceled is high, and this invention aims at offering a small and cheap output unit.

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EFFECT OF THE INVENTION

[Effect of the Invention] This invention became possible [offering the motor which can be made to generate the high output of positioning accuracy by having a stator with the salient pole which learned in the shape of / of the magnetization band magnetized by the rod / a screw type, and was formed so that it may fit into the male side MAG screw with which the magnetization band of band-like N pole and the south pole was magnetized spirally, and a male side MAG screw in the state of non-contact to the rod which consists of a ferromagnetic material]. Moreover, this invention became possible [offering an output unit with positioning accuracy it being high and small and cheap] by having carried out to making a rod generate a thrust by the rotating magnetic field produced by energizing the coil of each phase wound around the stator by restricting rotation of a rod and supporting free [sliding] to shaft orientations, while it has the motor mentioned above and the stator is fixed.

[0023] Moreover, by supporting a stator free [sliding] to the shaft orientations of a rod, while it has the motor mentioned above and the rod is fixed, this invention is making the stator concerned generate a thrust by the rotating magnetic field produced by energizing the coil of each phase wound around the stator, and became possible [offering an output unit with positioning accuracy it being high and small and cheap]. Moreover, it is what is guided in the rail slot formed in the frame on which the guidance projection which this invention was equipped with the motor mentioned above, and protruded perpendicularly to the rod supports a stator. Since a rod promotes or rotates according to a rail slot by the rotating magnetic field produced by energizing the coil of each phase wound around the stator The degree of freedom of the output direction was increased and positioning accuracy became possible [offering a small and cheap output unit highly].

[Translation done.]

band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material. Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. By the rotating magnetic field which the guidance projection which protruded perpendicularly to said rod is guided in the rail slot formed in the frame which supports said stator, makes energize the coil of each phase wound around said stator, and produces it is characterized by said rod promoting or rotating according to said rail slot.

[0010] [Embodiment of the Invention] Next, the gestalt of 1 operation of this invention is explained. Drawing 1 is the decomposition appearance perspective view having shown the motor which is the important section of an output unit. The magnet with which N pole magnetization band 3 and the south pole magnetization band 4 were formed is * * * (ed) by the rod 2 with which the male side MAG screw 1 makes an axis. Ferromagnetic ingredients (for example, compound of the alloy which makes a principal component iron, ferrous oxide, nickel, cobalt, or these, and others etc.) are used for this rod 2. This is for making the generating consistency of line of magnetic force increase. It is a beltlike magnetization band with parallel N pole magnetization band 3 and south pole magnetization band 4, and it exists over the perimeter and the male side MAG screw 1 is constituted.

[0011] On the other hand, the salient pole 12 and 12 — by which the skew pole magnetization band 3 which constitutes the male side MAG screw 1, and the south pole magnetization band 4] a screw type are formed. The stratification steel plate with which permeability lets magnetic flux pass well highly as an ingredient of a stator 11 is used. A non-illustrated coil is wound around a salient pole 12 and 12 —, and it is fixed to them by resin, and connects with the non-illustrated control system. In addition, with the gestalt of this operation, it is the coil format of the coil of the three-phase alternating current. And it is prepared so that it may penetrate, as the male side MAG screw 1 shows such a stator 11 to drawing 2, and the motor 18 is constituted.

[0012] In the drive of a motor 18, a rate command value and the amount of rate feedbacks of a rod 2 are compared, and it is outputted as a command value of the amplitude of the current which changes to a sine wave. With the gestalt of this operation, the amplitude which generates forward and counterclockwise rotation (CCW) torque for the amplitude which generates clockwise rotation (CW) torque is made negative. And the result of having

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MEANS

[Means for Solving the Problem] The motor of this invention is a motor which has a stator with the salient pole which learned in the shape of [of the magnetization band which fitted into the male side MAG screw with which the magnetization band of band-like N pole and the south pole was magnetized spirally, and said male side MAG screw in the state of non-contact to the rod which consists of a ferromagnetic material, and was magnetized by said rod] a screw type, and was formed. The male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material. Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. It is characterized by making said rod generate a thrust by the rotating magnetic field produced by energizing the coil of each phase wound around said stator by fixing said stator and supporting said rod free [sliding] to shaft orientations.

[0008] Moreover, the male side MAG screw with which the magnetization band of band-like N pole and the south pole was spirally magnetized to the rod with which the output unit of this invention consists of a ferromagnetic material. Fit into said male side MAG screw in the state of non-contact, and it has the motor which has a stator with the salient pole which learned in the shape of [of the magnetization band magnetized by said rod] a screw type, and was formed. It is characterized by making the stator concerned generate a thrust by the rotating magnetic field which are made to energize the coil of each phase wound around said stator, and are produced by fixing said rod and supporting said stator free [sliding] to the shaft orientations of said rod.

[0009] Moreover, the male side MAG screw with which the magnetization

magnetized spirally. Therefore, rectilinear motion will be outputted for the male side MAG screw 1 to right and left of a drawing by CW torque or CCW torque generated in a stator 11 with a current command value. [0016] It became unnecessary therefore, to form the means of communication which does not need to form a drive motor separately like the conventional example, and transmits the output of the drive motor to a driving side by having constituted the motor 18 which adopted the stator 11 as a driving source of the thrust generated on the male side MAG screw 1 according to the output unit 21 of the gestalt of this operation. Therefore, while component parts were reduced and the output unit itself was miniaturized, the cost cut was able to be aimed at by deletion of components mark.

[0017] Moreover, while according to the output unit 21 of the gestalt of this operation being able to enlarge torque and attaining the large output of a thrust by passing a big current to the coil of a stator 11, the positioning accuracy in a half location increased. Moreover, since rotating magnetic field are generated and it was made to make shaft orientations generate a thrust by giving running torque to the male side MAG screw 1 magnetized spirally by energizing the coil wound around the salient pole by which the skew was carried out spirally so that it may learn from the salient pole, a continuous fixed thrust arises on the male side MAG screw 1, and the rectilinear motion stabilized more could be outputted to it.

[0018] Next, the gestalt of the 2nd operation of the output unit concerning this invention is explained. Although it is an output unit using the motor 18 which also mentioned the gestalt of this operation above, especially a rotation output is possible. Drawing 4 is the flank sectional view having shown the output unit of the gestalt of this operation, and drawing 5 is the top view having shown the output unit of the gestalt of this operation. The rod 2 protrudes from the support lids 33 and 34 with which the stator 11 was fixed in the hollow cylinder frame 32, and the output unit 31 of the gestalt of this operation was fixed before and after the hollow cylinder frame 32 (drawing right and left). On the other hand, the guidance rod 35 is perpendicularly attached in a rod 2, and it is equipped with the roller 36 so that it may be located on hollow cylinder frame 32 periphery. And on the hollow cylinder frame 32, the guide rail 37 of the shape of L character as shown in drawing 5 cuts and lacks. The guide rail 37 consists of a bay which cut in the direction of an axis of the hollow cylinder frame 32, and withered in **, and the rotation section cut and lacked in the circumferencial direction.

[0019] By supplying a command current to the coil of each phase of a stator 11 from a control system, rotating magnetic field are generated. N

carried out the multiplication of this command value and the command value of a phase (120 degrees has shifted at a time) becomes the actual command value of each phase. The information on the phase of a three phase is stored in ROM, and it is constituted so that an appropriate phase value may be read by the information from a program. If each coil three-phase alternating current flows by the current command of each phase, the read-out phase from ROM will be adjusted so that the synthetic vector of the current of each phase may become in the 90-degree direction to a field bundle required to rotate the male side MAG screw 1. [0013] And the force in which it rotates the male side MAG screw 1 by the rotating magnetic field produced by changing the current command value of each phase is given. That is, N pole magnetization band 3 and the south pole magnetization band 4 are attracted according to the excitation force which a coil energizes and is produced in a salient pole 12 and 12 **, and turning effort is given to the male side MAG screw 1 by the changing current command. Therefore, since according to this motor 18 it always meets and acts, without N pole magnetization band 3 and the spiral south pole magnetization band 4 and a spiral salient pole 12, and 12 ** shifting, positioning accuracy is high and stable smooth movement is outputted from a rod 2.

[0014] And the gestalt of the 1st and 2nd operation is shown and the output unit using the motor 18 of such a configuration is explained below. First, drawing 3 is the top view having shown the output unit of the gestalt of the 1st operation. This output unit 21 aims at outputting rectilinear motion from the rod 2 with which the male side MAG screw 1 was formed. The rod 2 with which the male side MAG screw 1 mentioned above was formed is arranged in the center of two guidance rods 22 and 23 for niting, and the both ends are fixed to support plates 24 and 25 with the guidance rods 22 and 23, and it has become the thing of one. On the other hand, a stator 11 is made into one and formed in the frame 28 equipped with the bearings 26 and 27 which carry out sliding support of the guidance rods 22 and 23. This frame 28 is being fixed to the non-illustrated base.

[0015] Then, rotating magnetic field are generated by supplying a command current to the coil of each phase of a stator 11 from a control system, as mentioned above. According to generating of rotating magnetic field, N pole magnetization band 3 and the south pole magnetization band 4 of the male side MAG screw 1 are attracted, and running torque works to a rod 2. However, since a rod 2 is constituted by the guidance rods 22 and 23 and one end rotation is restricted, the running torque will be transmitted as a thrust of shaft orientations to N pole magnetization band 3 and the south pole magnetization band 4 of the male side MAG screw 1 which were

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

Drawing 1 It is the decomposition appearance perspective view having shown the motor which is the important section of the output unit concerning this invention.

Drawing 2 It is the appearance perspective view having shown the motor which is the important section of the output unit concerning this invention.

Drawing 3 It is the top view having shown the output unit of the gestalt of the 1st operation.

Drawing 4 It is the flank sectional view having shown the output unit of the gestalt of the 2nd operation.

Drawing 5 It is the top view having shown the output unit of the gestalt of the 2nd operation.

Drawing 6 It is the flank sectional view having shown the conventional output unit.

[Description of Notations]

- 1 Male Side MAG Screw
- 2 Rod
- 3 N Pole Magnetization Band
- 4 South Pole Magnetization Band
- 11 Stator
- 12 Salient Pole
- 18 Motor
- 21 Output Unit
- 28 Frame

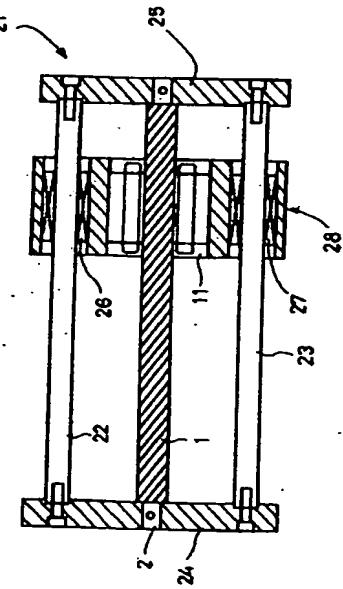
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pole magnetization band 3 and the south pole magnetization band 4 of the male side MAG screw 1 are attracted, and running torque commits the output unit 31 of the gestalt of this operation which consists of such a configuration to a rod 2. However, since the motion of a hand of cut is restricted when a rod 2 has the guidance rod 35 in the bay of a guide rail 37, the running torque will be transmitted as a thrust of shaft orientations to the male side MAG screw 1 magnetized spirally. A roller 36 will roll the bay of a guide rail 37. Rectilinear motion is restricted shortly in the place where the guidance rod 35 moved on the other hand to the location which the rotation section of a guide rail 37 cut and lacked. Therefore, the rotating magnetic field by the stator 11 will be changed into the running torque of the male side MAG screw 1, a rod 2 will rotate it, and a roller 36 will roll the rotation section of a guide rail 37. Therefore, from a rod 2, movement of rectilinear propagation and rotation will be outputted continuously. And movement which followed the guide rail 37 conversely is outputted by CW torque or CCW torque generated in a stator 11 with a current command value.

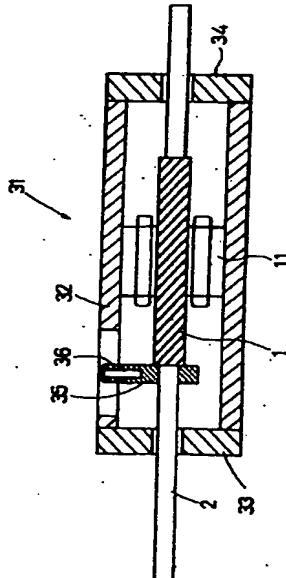
[0020] Therefore, the output unit 31 of the gestalt of this operation does so the effectiveness of being able to output movement which could aim at the cost cut by deletion of components mark like the thing of the gestalt of said 1st operation while the output unit itself was miniaturized, could raise the positioning accuracy in a half location while the large output of a thrust was attained, and was stabilized more. And since a straight line and rotation were made to be outputted from the rod 2 further according to 32 guide rails 37 formed in the hollow cylinder frame according to the output unit 31 of the gestalt of this operation, the width of face of the application became what spread more.

[0021] In addition, various modification is possible for this invention in the range which is not limited to the gestalt of said operation and does not deviate from the meaning. For example, although it constituted from a gestalt of said 1st operation so that the rectilinear motion of shaft orientations might be outputted to a rod 2 by fixing the frame 28 which has a stator 11, it may be made to carry out rectilinear motion of frame 28 itself by the rotating magnetic field which make it generate from a stator 11 by fixing the rod 2 which contains the male side MAG screw 1 conversely. the rotating magnetic field which make it generate from a stator 11 by this being the same also in the gestalt of the 2nd operation, fixing a rod 2, and making the hollow cylinder frame 32 into a free condition — 4 hollow cylinder frame 32 itself — a straight line — and you may make it rotate

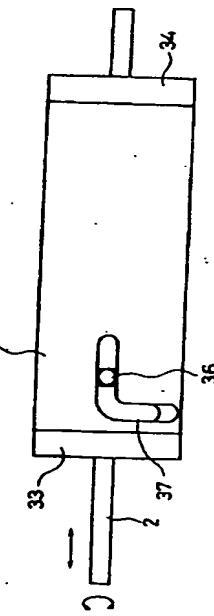
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[Drawing 4]



[Drawing 5]

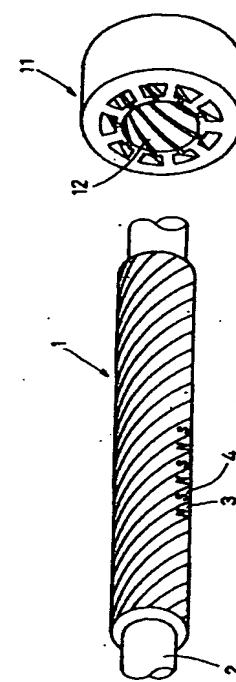
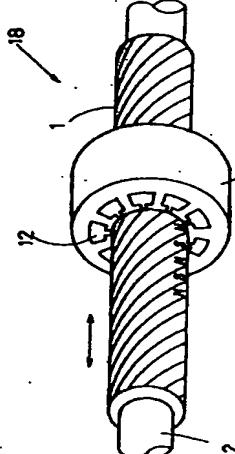


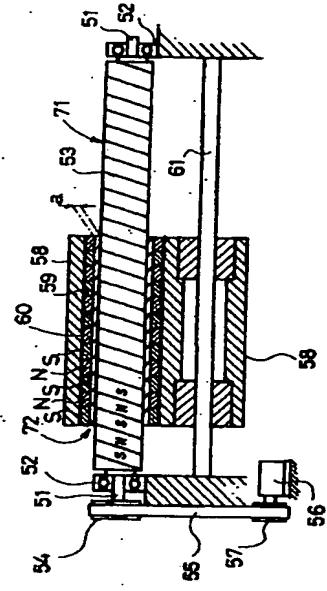
[Drawing 6]

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DRAWINGS[Drawing 1][Drawing 2][Drawing 3]



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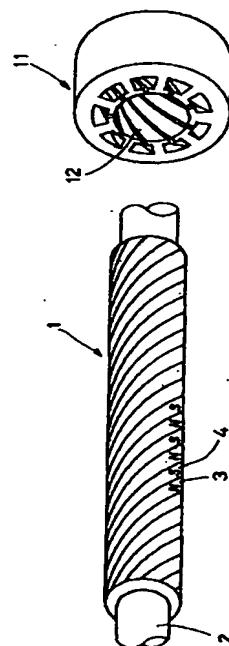
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(54)【発明の名称】 モータ及びそのモータを備えた出力装置

(57)【要約】

【課題】 位置決め精度の高い出力を発生させることができるモータ、またそのようなモータを備えた位置決め精度が高く、小型で安価な出力装置を提供すること。

【解決手段】 本発明は、強磁性体材料からなるロッド2に対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジ1と、雄側磁気ネジ1に非接触状態で嵌合するよう、ロッド2に着磁された着磁帯の螺旋形状にならって形成された突極をもつステータ11とを有するモータである。



【特許請求の範囲】

【請求項1】 強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、

前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有することを特徴とするモータ。

【請求項2】 強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ステータを固定し、前記ロッドを軸方向へ摺動自在に支持することにより、前記ステータに巻回された各相のコイルを通電させて生じる回転磁界によって前記ロッドに推力を発生させることを特徴とする出力装置。

【請求項3】 強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ロッドを固定し、前記ステータを前記ロッドの軸方向に摺動自在に支持することにより、前記ステータに巻回された各相のコイルを通電させて生じる回転磁界によって当該ステータに推力を発生させることを特徴とする出力装置。

【請求項4】 強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ロッドに対し垂直に突設された案内突起が、前記ステータを支持するフレームに形成されたレール溝に案内されるものであって、前記ステータに巻回された各相のコイルを通電させて生じる回転磁界によって、前記ロッドが前記レール溝に従って推進又は回転することを特徴とする出力装置。

【発明の詳細な説明】

【0001】

【発明の属する技術分野】 本発明は、磁気ネジを利用してモータ並びにそのモータによって直線運動及び回転運動を出力を制御する出力装置に関する。

【0002】

【従来の技術】 従来から、磁石を螺旋形状に着磁した雄側磁気ネジと雌側磁気ネジとの組合せによって形成した磁気ネジを利用し、回転運動を直進運動に変換して出力する出力装置が開示されている。そこで、出力装置の一従来例として特開平1-209222号公報に掲載されたものを示して説明する。図6は、当該公報で開示された出力装置を示した断面図であり、以下のような構成を

なしている。両端をフレーム等の固定部に取り付けられたボールベアリングの軸受52に回転自在に軸51が支持され、その軸51表面にはS極及びN極の帯状のマグネット53が交互に螺旋状に着磁されて雄側磁気ネジ71が構成されている。そして、軸受52に支持された軸51の一端にはブーリ54が固定され、モータ56のブーリ57との間にベルト55が掛け渡されている。

【0003】 断面が示された搬送台58は、移動時に回転しないように設けられたガイド棒61と雄側磁気ネジ71とを包むように設けられている。そして、この搬送台58の円筒孔59内側には、S極とN極の帯状のマグネット60が螺旋状に巻き込むように着磁された雌側磁気ネジ72が構成されている。また、マグネット53とマグネット60とは、軸51が貫通する円筒孔59内で互いに接触しないよう間隔aだけ空けられて配設されている。

【0004】 このように磁気ネジを利用して構成された出力装置は、モータ56の駆動によって回転出力がベルト55を介して軸51に伝達される。一方、雄側磁気ネジ71と雌側磁気ネジ72との間では、その軸51に巻かれたマグネット53と搬送台58に取り付けられたマグネット60との磁力作用が生じ、互いに吸引し合っている。そのため、軸51の回転すれば、マグネット53の回転が回転の制限された搬送台58のマグネット60の推進力となって、その搬送台58がガイド棒61に沿って直線的に移動することとなる。また、モータ56を逆に回転させれば、両マグネットには逆方向に磁力が作用して搬送台58は復動することとなる。

【0005】 【発明が解決しようとする課題】 ところが、このような従来の出力装置では、雄側磁気ネジ71を回転させるには、回転軸51及びモータ56の出力軸に設けたブーリ54、56に掛け渡されたベルト55を介して伝達するよう構成されているため、停止時或いは逆転時にバックラッシュを起こし、位置精度が出ないといった問題点があった。また、これら駆動系のスペースが必要となって装置自体が大型化することになるとともに、駆動系に要する費用により装置の価格を上げる原因となっていた。

【0006】 そこで、本発明は、かかる問題点を解消すべく、位置決め精度の高い出力を発生させることができるモータ、またそのようなモータを備えた位置決め精度が高く、小型で安価な出力装置を提供することを目的とする。

【0007】

【課題を解決するための手段】 本発明のモータは、強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつス

データとを有するモータ。本発明の出力装置は、強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ステータを固定し、前記ロッドを軸方向へ摺動自在に支持することにより、前記ステータに巻回された各相のコイルを通電することにより生じる回転磁界によって前記ロッドに推力を発生させることを特徴とする。

【0008】また、本発明の出力装置は、強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ロッドを固定し、前記ステータを前記ロッドの軸方向に摺動自在に支持することにより、前記ステータに巻回された各相のコイルを通電させて生じる回転磁界によって当該ステータに推力を発生させることを特徴とする。

【0009】また、本発明の出力装置は、強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、前記雄側磁気ネジに非接触状態で嵌合し、前記ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有するモータを備え、前記ロッドに対し垂直に突設された案内突起が、前記ステータを支持するフレームに形成されたレール溝に案内されるものであって、前記ステータに巻回された各相のコイルを通電させて生じる回転磁界によって、前記ロッドが前記レール溝に従って推進又は回転することを特徴とする。

【0010】

【発明の実施の形態】次に、本発明の一実施の形態について説明する。図1は、出力装置の要部であるモータを示した分解外観斜視図である。雄側磁気ネジ1は軸芯をなすロッド2に、N極着磁帯3及びS極着磁帯4が形成された磁石が覆装されている。このロッド2には、強磁性材料（例えば鉄、酸化鉄、ニッケル、コバルト若しくはこれらを主成分とする合金その他の化合物等）が使用される。これは、磁力線の発生密度を増加させるためである。N極着磁帯3及びS極着磁帯4は、平行帯状な着磁帯であり、周間にわたって存在し雄側磁気ネジ1が構成されている。

【0011】一方、ステータ11は、雄側磁気ネジ1を構成するN極着磁帯3及びS極着磁帯4の螺旋形状にならうようスキューレされた突極12、12…が形成されている。ステータ11の材料としては、透磁率が高く磁束を良く通す成層鋼板が用いられている。突極12、12…には、不図示のコイルが巻回され樹脂で固定され、不図示の制御系に接続されている。なお、本実施の形態で

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は、三相交流の巻線の巻線形式である。そして、このようなステータ11を雄側磁気ネジ1が図2に示す如く貫通するように設けられてモータ18が構成されている。

【0012】モータ18の駆動においては、速度指令値とロッド2の速度フィードバック量とが突き合わされ、正弦波に変化する電流の振幅の指令値として出力される。本実施の形態では、時計方向(CW)トルクを発生する振幅を正、反時計方向(CCW)トルクを発生する振幅を負とする。そして、この指令値と位相(120°ずつずれている)の指令値を乗算した結果が各相の実際の指令値になる。三相の位相の情報は、ROMに格納され、プログラムからの情報によって、しかるべき位相値が読み出されるように構成されている。各相の電流指令によって各巻線三相交流が流れると、各相の電流の合成ベクトルは、雄側磁気ネジ1を回転させようとするのに必要な界磁束に対して90°の方向になるように、ROMからの読み出し位相が調節される。

【0013】そして、各相の電流指令値を変化させることによって生じる回転磁界によって雄側磁気ネジ1を回転させようとする力が与えられる。即ち、コイルが通電されて突極12、12…に生じる励磁力によって、N極着磁帯3及びS極着磁帯4が吸引され、変化する電流指令によって雄側磁気ネジ1に回転力が与えられる。そのため、本モータ18によれば、螺旋状のN極着磁帯3及びS極着磁帯4と突極12、12…がずれることなく常に対面して作用するので、位置決め精度が高く、またロッド2からは安定したスムーズな運動が outputされる。

【0014】そして、このような構成のモータ18を利用した出力装置について、第1、第2実施の形態を示して以下に説明する。先ず、図3は、第1実施の形態の出力装置を示した平面図である。本出力装置21は、雄側磁気ネジ1の形成されたロッド2から直線運動を出力することを目的とするものである。前述した雄側磁気ネジ1の形成されたロッド2は、回転止めのための2本の案内ロッド22、23の中央に配置し、その両端が案内ロッド22、23とともに支持板24、25に固定され一体のものとなっている。一方、ステータ11は、案内ロッド22、23を摺動支持する軸受け26、27を備えたフレーム28に一体にして形成されている。このフレーム28は、不図示の台に固定されている。

【0015】そこで、前述したように制御系からステータ11の各相のコイルへ指令電流を供給することによって回転磁界を発生させる。回転磁界の発生により、雄側磁気ネジ1のN極着磁帯3及びS極着磁帯4が吸引されロッド2に回転トルクが働く。しかし、ロッド2は、案内ロッド22、23と一緒に構成され回転が制限されているため、その回転トルクは、螺旋状に着磁された雄側磁気ネジ1のN極着磁帯3及びS極着磁帯4に対して軸方向の推力として伝達されることとなる。そのため、電流指令値によってステータ11に発生するCWトルク又

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はCCWトルクによって、雄側磁気ネジ1が図面の左右へ直線運動が outputされることとなる。

【0016】従って、本実施の形態の出力装置21によれば、雄側磁気ネジ1に発生する推力の駆動源としてステータ11を採用したモータ18を構成したことによって、従来例のように別途駆動モータを設ける必要がなく、またその駆動モータの出力を駆動側へ伝達する伝達手段を設ける必要がなくなった。そのため、構成部品が削減されて出力装置自体が小型化されるとともに、部品点数の削除によりコストダウンを図ることができた。

【0017】また、本実施の形態の出力装置21によれば、ステータ11のコイルへ大きな電流を流すことによってトルクを大きくすることができ、推力の大きい出力が可能となるとともに、停止位置での位置決め精度が高まった。また、螺旋状にスキーされた突極に巻回されたコイルを通電することによって回転磁界を発生させ、その突極にならうよう螺旋状に着磁された雄側磁気ネジ1に回転トルクを与えることで軸方向に推力を発生させるようにしたので、雄側磁気ネジ1には連続する一定の推力が生じ、より安定した直線運動が outputできるようになった。

【0018】次に、本発明にかかる出力装置の第2実施の形態について説明する。本実施の形態も、前述したモータ18を利用した出力装置であるが、特に回転出力が可能なものである。図4は、本実施の形態の出力装置を示した側部断面図であり、図5は、本実施の形態の出力装置を示した平面図である。本実施の形態の出力装置31は、ステータ11が中空円筒フレーム32内に固定され、その中空円筒フレーム32の前後(図面左右)に固定された支持蓋33、34からロッド2が突設されている。一方、ロッド2には案内ロッド35が垂直に取り付けられ、中空円筒フレーム32円周上に位置するようローラ36が装着されている。そして、中空円筒フレーム32には図5に示すようなL字状の案内溝37が切り欠かれている。案内溝37は、中空円筒フレーム32の軸線方向に切り欠かかれた直線部と、その円周方向に切り欠かれた回転部とから構成されている。

【0019】このような構成からなる本実施の形態の出力装置31は、制御系からステータ11の各相のコイルへ指令電流を供給することによって回転磁界が発生され、雄側磁気ネジ1のN極着磁帯3及びS極着磁帯4が吸引されロッド2に回転トルクが働く。しかし、ロッド2は、案内ロッド35が案内溝37の直線部にある場合、回転方向の動きが制限されているため、その回転トルクは、螺旋状に着磁された雄側磁気ネジ1に対して軸方向の推力として伝達されることとなる。ローラ36は、案内溝37の直線部を転がることとなる。一方、案内ロッド35が案内溝37の回転部が切り欠かれた位置まで移動したところで、今度は直線運動が制限される。そのため、ステータ11による回転磁界は、雄側磁気ネ

ジ1の回転トルクに変換されてロッド2が回転し、ローラ36は案内溝37の回転部を転がることとなる。従って、ロッド2からは直進及び回転の運動が連続して出力されることとなる。そして、電流指令値によってステータ11に発生するCWトルク又はCCWトルクによって、案内溝37を逆にたどった運動が outputされる。

【0020】従って、本実施の形態の出力装置31は、前記第1実施の形態のものと同様に、出力装置自体が小型化されるとともに、部品点数の削除によりコストダウンを図ることができ、推力の大きい出力が可能となるとともに、停止位置での位置決め精度を高めることができ、また、より安定した運動が outputできるなどの効果を奏するものである。そして、更に、本実施の形態の出力装置31によれば、中空円筒フレームに形成した32案内溝37に従ってロッド2から直線及び回転運動が outputされるようにしたので、その用途の幅がより広がったものとなつた。

【0021】なお、本発明は前記実施の形態に限定されるものではなく、その趣旨を逸脱しない範囲で様々な変更が可能である。例えば、前記第1実施の形態では、ステータ11を有するフレーム28を固定することでロッド2に軸方向の直線運動を outputするよう構成したが、逆に雄側磁気ネジ1を含むロッド2を固定することによりステータ11から発生させる回転磁界によってフレーム28自らを直線運動させるようにしてもよい。このことは、第2実施の形態においても同様であり、ロッド2を固定し中空円筒フレーム32をフリーの状態として、ステータ11から発生させる回転磁界によつて中空円筒フレーム32自らを直線及び回転運動させるようにしてもよい。

【0022】

【発明の効果】本発明は、強磁性体材料からなるロッドに対し、帯状のN極及びS極の着磁帯が螺旋状に着磁された雄側磁気ネジと、雄側磁気ネジに非接触状態で嵌合するよう、ロッドに着磁された着磁帯の螺旋形状にならって形成された突極をもつステータとを有することで、位置決め精度の高い出力を発生させることができるモータを提供することが可能となった。また、本発明は、前述するモータを備え、そのステータを固定する一方、ロッドの回転を制限し軸方向へ摺動自在に支持することにより、ステータに巻回された各相のコイルを通電することにより生じる回転磁界によってロッドに推力を発生させることとしたことにより、位置決め精度が高く、また小型で安価な出力装置を提供することが可能となった。

【0023】また、本発明は、前述するモータを備え、そのロッドを固定する一方、ステータをロッドの軸方向に摺動自在に支持することにより、ステータに巻回された各相のコイルを通電することにより生じる回転磁界によって当該ステータに推力を発生させることで、位置決め精度が高く、また小型で安価な出力装置を提供する

ことが可能となった。また、本発明は、前述するモータを備え、ロッドに対し垂直に突設された案内突起がステータを支持するフレームに形成されたレール溝に案内されるものであって、ステータに巻回された各相のコイルを通電することによって生じる回転磁界によって、ロッドがレール溝に従って推進又は回転することとしたので、出力方向の自由度を増したものであって、位置決め精度が高く、また小型で安価な出力装置を提供することが可能となった。

【図面の簡単な説明】

【図1】本発明に係る出力装置の要部であるモータを示した分解外観斜視図である。

【図2】本発明に係る出力装置の要部であるモータを示した外観斜視図である。

【図3】第1実施の形態の出力装置を示した平面図である。

* 【図4】第2実施の形態の出力装置を示した側部断面図である。

【図5】第2実施の形態の出力装置を示した平面図である。

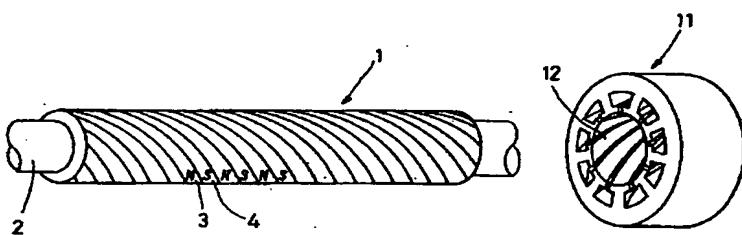
【図6】従来の出力装置を示した側部断面図である。

【符号の説明】

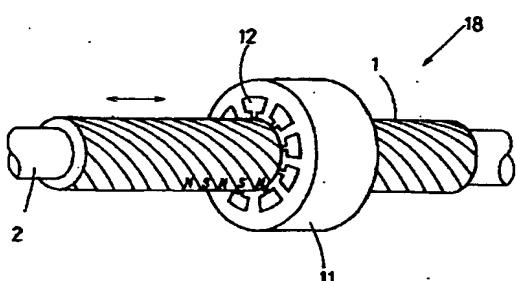
1	雄側磁気ネジ
2	ロッド
3	N極着磁帶
4	S極着磁帶
10	11 ステータ
12	12 突極
18	18 モータ
21	21 出力装置
28	28 フレーム

*

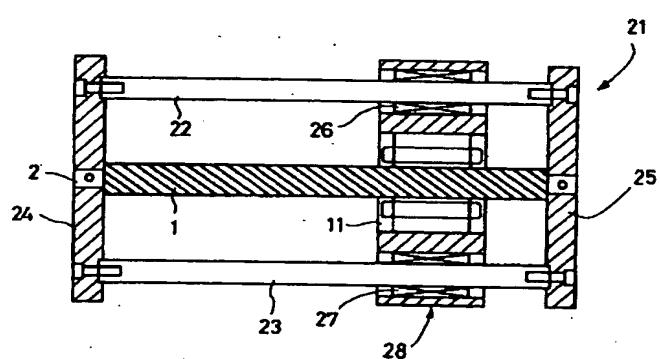
【図1】



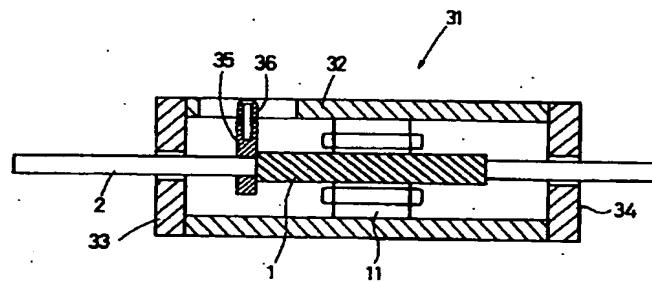
【図2】



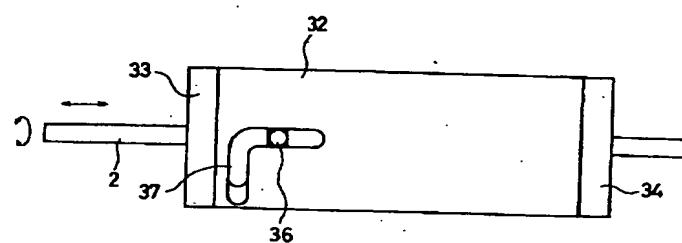
【図3】



【図4】



【図5】



【図6】

